ANNUAL LABORATORY CHECKUP: EARLY SIGNS OF HEALTH PROMBLEMS IN YOUNG AND MIDDLE-AGE ADULTS

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Abstract. The objective of this descriptive study was to review the usefulness and relevance of the present parameters provided in an annual laboratory health checkup program. Three hundred sixty-four volunteers were randomly selected, composed of 141 males and 223 females age 15 to 81 years old. Samples from all the volunteers were analyzed for CBC, FBG, BUN, Cr, uric acid, Chol, HDLc, Tg, AST, ALT, ALP, UA and stool examination. More than half the young adults (67.7%, 63 of 93) had abnormal laboratory results. This was higher than in the middle-age group (56.8%, 154 of 271).

INTRODUCTION

All private and governmental employees are recommended to have a physical examination once a year. The basic health checkup includes vital signs, physician's examination, chest roentgenography (chest x-ray), and laboratory investigations. In addition, Papanicolaou's smear (pap smear) screening for cervical cancer is also included in the annual checkup for females. According to the regulation of the Ministry of Finance (MOF), laboratory investigations for the governmental employees are divided into two different panels. One is the panel for under 35 years old (<35), and the other panel is for 35 years old and over (≥35) (Suntorntham, 2001). These panels are applied to private employees as well. The panel for employees <35 years old is as follows: complete blood count (CBC), urinalysis (UA), ABO blood group, and stool examination. The panel for employees ≥35 years old is different by adding blood chemistry parameters, such as: fasting blood glucose (FBG), blood urea nitrogen (BUN), creatinine (Cr), uric acid, cholesterol (Chol), triglyceride (Tg), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP). All governmental employees can have an annual checkup once a year under governmental subsidization. Therefore, in order to control the budget, test parameters have been limited by the MOF since 1994. The cost for the laboratory investigation for employees <35 years old and ≥35 years old, has been limited to 170 baht and 620 baht, respectively.

To review the relevance of the current laboratory panels, we analyzed the annual laboratory data in volunteers who had normal vital signs, and doctor's physical examination at both private and governmental organizations.

MATERIALS AND METHODS

This study protocol was approved by the Ethics Committee, Faculty of Medicine, Chulalongkorn University. All subjects were checked for vital signs, and had a physical examination by a physician. All volunteers were interviewed and gave written consent before participation. Three hundred sixty-four volunteers were randomly selected. Most of them were employees of private or governmental organizations partici-

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pating in the annual checkup program, at King Chulalongkorn Memorial Hospital (KCMH), during July to November 2003. There were 141 males and 223 females, age 15 to 81 years old. The weight (kg) and height (m) of all the volunteers was recorded to calculate the body mass index (BMI) (WHO, 1998). The BMI was calculated by dividing the weight in kg by the height in m^2 (BMI = kg/m^2). A BMI lower than 18.5 was considered underweight (asthenic), 18.5 to 24.9 was considered normal, 25.0 to 29.9 was considered overweight, and 30.0 and above was classified as obese (NIH, 2004). All the volunteers had the same laboratory panel: CBC, FBG, BUN, Cr, uric acid, Chol, high-density lipoprotein cholesterol (HDLc), Tg, AST, ALT, ALP, UA, and stool examination.

The mean and range for each parameter was calculated. Unpaired Student's *t*-test was used to calculate the differences of the results between and within the group. Statistically significant differences were set at $p \leq 0.05$. The Pearson correlation coefficient was used for association calculation (Bell, 1995).

RESULTS

Our volunteers were divided into two groups based on their age: <35 years old (young adult group), and ≥35 years old (middle-age adult group). All the subjects were also divided into two groups based on their laboratory results. Individuals with normal laboratory results and individuals with abnormal laboratory results. The normal individuals with normal laboratory results were considered healthy subjects. The normal individuals with abnormal laboratory results were considered unhealthy subjects. Without laboratory results, it is difficult to differentiate between these two groups. We found that 217 of 364 (59.6%) normal individuals had abnormal laboratory results (Table 1). These 217 unhealthy subjects were composed of 63 of 93 (67.7%) young adults and 154 of 271 (56.8%) middle-age adults (Table 1). We found that chemistries were abnormal in 116 subjects, while 41 subjects had abnormal in hematologies. Sixty subjects had a combination of abnormality of chemistry and hematology results. The laboratory results are shown in Table 2. The lipid levels are shown in Table 3. To look for an association between alcohol consumption and abnormal chemistry laboratory results, we divided these with and without alcohol consumption into normal (188 of 364) and abnormal (176 of 364) chemistry laboratory groups. We found that 27.8% (91 of 364) of employees drank alcohol. Of these, 4.7% (17 of 364) were regular drinkers. In the normal chemistry laboratory group, only 1.1% (2 of 188) were regular drinkers, while in the abnormal chemistry laboratory group, 8.5% (15 of 176) were regular drinkers. We also analyzed the details of the abnormal chemistry laboratory results. We found that dyslipidemia was the commonest abnormality among our subjects. Of those with abnormal chemistry findings, 84.1% (148 of 176) had dyslipidemia. Among these, 77.8% (137 of 176) had hyperlipidemia. Hyperglycemia, hyperuricemia, and abnormal liver enzymes were found in 9.7% (17 of 176), 21.0% (37 of 176), and 30.7% (54 of 176), respectively. Dyslipidemia, hyperglycemia, hyperuricemia, and abnormal liver enzymes were found in 40.7% (148 of 364), 4.7% (17 of 364), 10.2% (37 of 364), and 14.8% (54 of 364) of our total subjects, respectively. The correlation factors are demonstrated in Table 4, which shows a significant correlation between BMI and chemistry abnormalities.

DISCUSSION

Our results demonstrate that more than half (59.6%) of ostensibly normal individuals were unhealthy subjects. This number is very high and should be carefully analyzed for causes and proper management. Though increasing age was expected to be associated with more abnormal laboratory results, this high percentage was unexpected. More than half the young adults (67.7%, 63 of 93) had abnormal laboratory results. This percentage is higher than the percentage of abnormal laboratories in the middle-age group (56.8%, 154 of 271). These results signal an alarming finding in the health of these young adults. Since these young adults were all Thai, race was not a modifying factor. Physical factors, such as life style, food, beverage, and smoking in these young people need to be analyzed for an explanation. In our study, we found that 12.1% (44 of 364) of employees smoke cigarettes. The ones who smoked more than 5 cigarettes per day (1.1%) were classified as unhealthy (Table 1). Health promotion and prevention poli-

pating in the annual checkup program, at King Chulalongkorn Memorial Hospital (KCMH), during July to November 2003. There were 141 males and 223 females, age 15 to 81 years old. The weight (kg) and height (m) of all the volunteers was recorded to calculate the body mass index (BMI) (WHO, 1998). The BMI was calculated by dividing the weight in kg by the height in m^2 (BMI = kg/m^2). A BMI lower than 18.5 was considered underweight (asthenic), 18.5 to 24.9 was considered normal, 25.0 to 29.9 was considered overweight, and 30.0 and above was classified as obese (NIH, 2004). All the volunteers had the same laboratory panel: CBC, FBG, BUN, Cr, uric acid, Chol, high-density lipoprotein cholesterol (HDLc), Tg, AST, ALT, ALP, UA, and stool examination.

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Table 1
The characteristics of 364 volunteers for yearly health examination.

Characteristics	Total	Healthy group	Unhealthy group
Number	364	147 (40.4%)	217 (59.6%)
<35 years old	93 (25.5%)	30 (8.2%)	63 (17.3%)
≥35 years old	271 (74.5%)	117 (32.2%)	154 (42.3%)
Ratio of <35: ≥35	1:2.9	1:3.9	1:2.4
Age			
Average (years old)	43.9	45.1	45.2
Range (years old)	15-81	18-81	15-77
Gender			
Males	141 (38.7%)	45 (12.4%)	96 (26.4%)
<35 years old	39	15	24
≥35 years old	102	30	72
Females	223 (61.3%)	102 (28.0%)	121 (33.3%)
<35 years old	54	15	39
≥35 years old	169	87	82
Ratio of M:F	1:1.6	1:2.3	1:1.3
Body mass index (BMI)			
Underweight	11 (3.0%)	8 (2.2%)	3 (0.8%)
Average	218 (59.9%)	91 (25.0%)	127 (34.9%)
Overweight	115 (31.6%)	43 (11.8%)	72 (19.8%)
Obese	20 (5.5%)	5 (1.4%)	15 (4.1%)
Working place			
In office	334 (91.8%)	131 (36.0%)	203 (55.8%)
M	123	35	88
F	211	96	115
In field	30 (8.2%)	10 (2.7%)	20 (5.5%)
M	18	6	12
F	12	4	8
Smoking habit			
Not smoke	320 (87.9%)	134 (36.8%)	186 (51.1%)
M	104	33	71
F	216	101	115
Smoke	44 (12.1%)	13 (3.6%)	31 (8.5%)
≤5 cigarettes per day			
M	33	11	22
F	7	2	5
>5 cigarettes per day			
M	4	0	4
F	0	0	0
Exercise habit			
Regular schedule	97 (26.6%)	43 (11.8%)	54 (14.8%)
M	46	20	26
F	51	23	28
Few/Sometimes	267 (73.4%)	104 (28.6%)	163 (44.8%)
M	95	25	70
F	172	79	93

cies for good health should be implemented before 35 years old. The laboratory panel should be reviewed, and more valuable tests added. From Table 2, we find that almost half the subjects had abnormal chemistry results (176 of 364, 48.4%), and about one-fourth had abnormal CBC results (101 of 364, 27.8%). Sixty of 364 (16.5%) subjects had abnormal results on both chemistry and CBC. Only 147 of 364 subjects had normal results on all laboratory investigations.

According to the BMI, we found that about

Table 2
The characteristics of laboratory results for 364 volunteers.

Characteristics	Total	Normal	Abnormal
Laboratory results			
Chemistry	364	188 (51.6%)	176 (48.4%)
CBC	364	263 (72.2%)	101 (27.8%)
Urinary	364	199 (54.5%)	165 (45.5%)
Stool examination	364	363 (99.7%)	1 (0.3%)

Table 3
The lipid levels of 364 volunteers.

Characteristics	Total	Healthy group	Unhealthy group
Lipid level			
Cholesterol:			
Average (mg/dl)	210	193[a]	225[a]
Range (mg/dl)	120-329	135-220	120-329
Triglyceride:			
Average (mg/dl)	113	85[a]	138[a]
Range (mg/dl)	33-439	33-150	41-439
HDLc			
Average (mg/dl)	58	60[a]	54[a]
Range (mg/dl)	24-92	38-107	21-164

[a] p-value ≤0.05 (p-value ≤0.05, is considered statistical significance)

37% of the volunteers were overweight or obese, 3% were underweight, and about 60% were normal weight. We also found a significant correlation ($p<0.01$) between BMI and chemistry abnormalities (Table 4). BMI and chemistry abnormalities suggested that nutrition problems are common in our population. An education program regarding health and nutrition should be implemented in our society. Our results suggest that lipid studies should be included in the annual laboratory panel for young adults. Our suggestion is supported by a recommendation from the Medical Practice Committee, American College of Physicians (1981), Canadian Task Force (CTF, 1993), and United States Preventive Services Task Force (USPSTF, 1989). In addition, there should be an additional policy to improve individuals with abnormal laboratory results. Otherwise, spending billions of baht on annual laboratory examinations will gain nothing except statistical data. Reviewing reports of hyperlipidemia in the Thai population from many years ago reveals that the number of people with hyperlipidemia has not changed much. The Cho, Tg, and HDLc in the healthy and unhealthy groups were significantly different (Table 3). We found that dyslipidemia was the commonest abnormality in our subjects (40.7%). Dyslipidemia is one of the major risk factors for cardiovascular diseases (CVD) (Charuruks *et al*, 1994). Nowadays, excluding accidents and cancer, CVD is the most common cause of death in the Thai population (DHS, 1999). Accidents are an unexpected events and hard to predict, while cancer is a multifactorial disease that is sometimes hard to prevent. However, CVD can be effectively prevented by modifying risk factors.

We summarized the characteristics of the laboratory results (Table 2). We found abnormal urine in 165 of 364 (45.5%). Most of the abnormalities were minor abnormalities, such as, mucous contamination, bacterial contamination, slightly cloudy or hazy urine, etc. Thirty-seven samples (10.2%) had abnormalities that should be further investigated. These abnormalities were higher than normal levels of RBCs, WBCs, glucose, protein, ketones, casts, and crystals. Our results suggest that the method of UA collec-

Table 4
The correlation of age, sex, BMI, working place, cigarette, alcohol, exercise, and chemistry results.

	Age Group	Sex	BMI	Working place	Exercise	Cigarette	Alcohol	Chemistry results
Age group								
Pearson correlation	1	-0.050	0.074	-0.115[a]	-0.113[a]	-0.061	-0.073	0.040
Sig (2-tailed)	.	0.342	0.160	0.028	0.031	0.244	0.163	0.444
N	364	364	364	364	364	364	364	364
Sex								
Pearson correlation	-0.050	1	0.134[a]	-0.092	-0.040	-0.233[b]	-0.343[b]	-0.013
Sig (2-tailed)	0.342	.	0.010	0.081	0.451	0.000	0.000	0.805
N	364	364	364	364	364	364	364	364
BMI								
Pearson correlation	0.074	0.134[a]	1	0.045	-0.002	-0.141[b]	-0.080	0.203[b]
Sig (2-tailed)	0.160	0.010	.	0.395	0.964	0.007	0.130	0.000
N	364	364	364	364	364	364	364	364
Working place								
Pearson correlation	-0.115[a]	-0.092	0.045	1	-0.075	0.140[b]	0.145[b]	-0.006
Sig (2-tailed)	0.028	0.081	0.395	.	0.152	0.007	0.006	0.903
N	364	364	364	364	364	364	364	364
Exercise								
Pearson correlation	-0.113[a]	-0.040	-0.002	-0.075	1	-0.047	-0.005	-0.045
Sig (2-tailed)	0.031	0.451	0.964	0.152	.	0.372	0.925	0.390
N	364	364	364	364	364	364	364	364
Cigarette								
Pearson correlation	-0.061	-0.233[b]	-0.141[b]	0.140[b]	-0.047	1	0.471[b]	-0.007
Sig (2-tailed)	0.244	0.000	0.007	0.007	0.372	.	0.000	0.895
N	364	364	364	364	364	364	364	364
Alcohol								
Pearson correlation	-0.073	-0.343[b]	-0.080	0.145[b]	-0.005	0.471[b]	1	0.061
Sig (2-tailed)	0.163	0.000	0.130	0.006	0.925	0.000	.	0.247
N	364	364	364	364	364	364	364	364
Chemistry results								
Pearson correlation	0.040	-0.013	0.203[b]	-0.006	-0.045	-0.007	0.061	1
Sig (2-tailed)	0.444	0.805	0.000	0.903	0.390	0.895	0.247	.
N	364	364	364	364	364	364	364	364

[a]Correlation is significant at the p<0.05 level (2-tailed).
[b]Correlation is significant at the p<0.01 level (2-tailed).

tion should be reviewed, since many of the samples were contaminated or collected improperly. All subjects should be advised to collect urine correctly. Our findings on UA are not compatible with previous studies (Hayward *et al*, 1991; Bhuripanyo *et al*, 2000). These may be due to many factors involved in any part of the pre-analytical, analytical, and post-analytical processes. Only one abnormal stool examination was noticed, it was the finding of cysts of *Giardia lamblia*. Our study show that stool examination in the annual health laboratory panel may not be cost-effective. Review of the necessity of stool examination for the annual health checkup program based on economic and symptomatic data is recommended.

Nutritional problems in our population are not the same as in the past. Nowadays we are facing the problem of nutrition changing toward western modernization. People live in more convenient cities but are forced to face a more competitive environment. They have more stress and less time for exercise. Only 26.6% (97 of 364) of our subjects had a regular exercise habit, while

27.8% (101 of 364) used alcohol beverages and 12.1% (44 of 364) had a smoking habit. More aggressive policies, such as providing correct information, encouragement of health promotion and prevention behaviors, follow-up of abnormal laboratory results, and consideration of bonus or punishment by reduction or increasing of insurance fees, might be considered. Although the government and private companies can limit the budget for the annual health checkup panels, it is useless if the strategy gives no improvement in the employees' health. Human resource is now considered the most important resource of each country in the globalization era. Currently, laboratory investigations are arranged into two panels, but the optimal panel for each individual may be set by the results of physical examination and additional quesionaires. The additional payment may be obtained from each employee if it is necessary. We strongly recommend furthermore studies regarding the screening laboratory panels and setting optimal values for the annual laboratory checkup.

Besides the panels, the method and quality of the laboratory evaluations should be considered as well. At present, the annual laboratory checkup is limited to the panels regardless of the method of analysis and quality of results. In spite of the reimbursement of billions of bath each year, the benefit of the panels has been rarely studied. All the laboratories performing laboratory services should be assessed to assure the clients that all services meet acceptable standards of quality.

We recommend annual health examinations and using the checkup data to monitor and improve the health of people. Because the checkup data must be reliable, standards of quality need to be evaluated. Additional interviews may be included in the annual health checkup program, because useful data may be obtained to update health policies. We strongly suggest that laboratory panels be reviewed, especially the panel for young adults (<35 years old).

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